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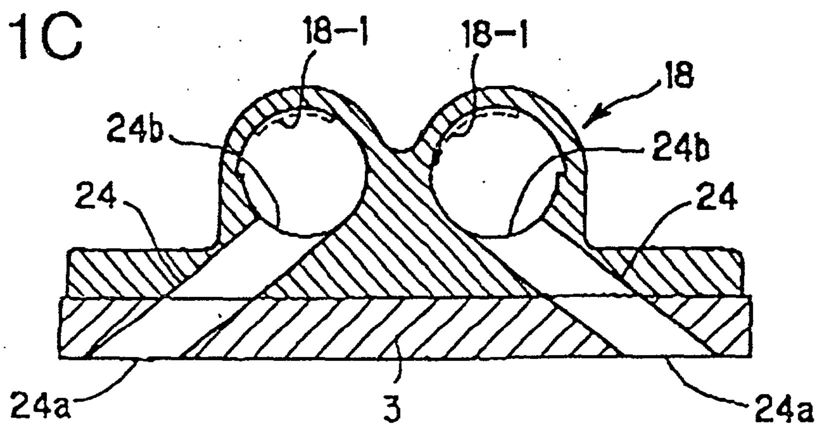
(54) **Gas compressor**

(57) To provide a gas compressor capable of reducing the pressure loss of the oil containing high-pressure refrigerant gas and achieving an improvement in compressor performance. In a construction in which oil containing high-pressure refrigerant gas discharged from cylinder discharge holes passes through discharge chambers and discharge gas passages to be led to oil separation filters side attached to an oil separator, the discharge gas passages are linear, whereby the oil containing high-pressure refrigerant gas flows smoothly through the discharge gas passages, and the pressure loss of the oil containing high-pressure refrigerant gas is reduced. Further, the height of inlet openings of the discharge gas passages are set to be the same as the height of outlet openings, whereby the discharge gas passages extend horizontally and are of the shortest length, thereby further reducing the pressure loss of the high-pressure refrigerant gas.

FIG. 1C



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Description

[0001] The present invention relates to a gas compressor mounted in a vehicle as a part of an automotive air conditioner system or mounted in an exterior unit as a part of an air conditioning system and, in particular, to a gas compressor in which the pressure loss of an oil containing high-pressure refrigerant gas is reduced to thereby achieve an improvement in compressor performance.

[0002] As shown in Fig. 3, an example of a gas compressor of this type has a cylinder 1 having a substantially elliptical inner peripheral configuration, side blocks 2 and 3 being respectively mounted to the end surfaces of the cylinder 1. A rotor 4 is arranged inside the cylinder 1 between the front and rear side blocks 2 and 3. The rotor 4 is horizontally positioned so as to be rotatable through a rotor shaft 5 integrally provided at its axial center and bearings 6 and 7 of the side blocks 2 and 3 supporting the same.

[0003] As shown in Fig. 4, five slit-like vane grooves 8 are formed radially in the rotor 4, and vanes 9 are respectively attached to these vane grooves 8, the vanes 9 being capable of jutting out from the outer peripheral surface of the rotor 4 toward the inner wall of the cylinder 1 and retracting into the rotor 4.

[0004] The interior of the cylinder 1 is divided into a plurality of small chambers by the inner wall of the cylinder 1, the inner surfaces of the side blocks 2 and 3, the outer peripheral surface of the rotor 4, and the side surfaces of the forward end portions of the vanes 9. The small chambers thus defined constitute compression chambers 10, whose volume is repeatedly varied as the rotor.4 rotates in the direction of the arrow RD.

[0005] In the case where the volume of the compression chamber 10 varies, at the time of increasing the volume of the compression chambers 10, the oil containing low-pressure refrigerant gas in a suction chamber 11 is introduced into the compression chambers 10 through suction passages 12 of the cylinder 1 and inlets 13 of the side blocks 2 and 3. Then, when the volume of the compression chambers 10 starts to decrease, the refrigerant gas in the compress ion chambers 10 starts to be compressed due to the volume reduction effect. Thereafter, when the volume of the compression chambers 10 approaches to its minimum, discharge valves 15 of cylinder discharge holes 14 provided near the elliptically short diameter portion of the cylinder 1 are opened by the pressure of the compressed oil containing high-pressure refrigerant gas. As a result, the oil containing high-pressure refrigerant gas in the compression chambers 10 are discharged through the cylinder discharge holes 14.

[0006] The oil containing high-pressure refrigerant gas discharged through the cylinder discharge holes 14 flows through discharge chambers 16 and discharge gas passages 24 in the outer periphery of the cylinder 1 before it is led to oil separation filters 18-1 of an oil separator 18 mounted to the rear portion of the side block 3.

[0007] The oil containing high-pressure refrigerant gas led to the oil separation filters 18-1 is separated into an oil component and a gas component as a result, for example, of striking against wire-meshes constituting the oil separation filters 18-1. The gas component flows into a discharge chamber 19, and is then supplied from the discharge chamber 19 to the condenser side of the air conditioning system by way of a discharge port of a compressor case (not shown). On the other hand, after the separation, the oil component drips down into an oil sump 20 at the bottom of the discharge chamber 19 to be stored, and is supplied to portions where oil is required through an oil passage 21 of the side blocks 2 and 3 and the cylinder 1. Examples of the portions where the oil is required include the clearances of the bearings 6 and 7, flat grooves 22 formed on the sides of the side blocks 2 and 3 facing the cylinder, and vane back pressure spaces 23 at the bottom of the vanes 9 communicating therewith.

[0008] However, as shown in Fig. 5, the above-described conventional gas compressor adopts a structure in which, to enhance the oil separation performance, the discharge gas passages 24 of the oil separator 18 are bent twice at right angles to thereby cause the oil containing high-pressure refrigerant gas to strike against the inner walls of the gas passages 24 twice. This striking construction provides little or no effect of improving the oil separation performance. Rather, it involves an increase in the pressure loss of the oil containing high-pressure refrigerant gas, which leads to deterioration in the compressor performance.

[0009] The present invention has been made with a view toward solving the above problem in the prior art. It is an object of the present invention to provide a gas compressor which can reduce the pressure loss of the oil containing high-pressure refrigerant gas to thereby achieve an improvement in compressor performance.

[0010] To achieve the above object, the present invention relates to a gas compressor comprising a cylinder arranged between a pair of side blocks, a rotor horizontally arranged in the cylinder so as to be rotatable, vanes provided so as to be capable of jutting out toward the inner wall of the cylinder from the outer peripheral surface of the rotor and retracting therein, compression chambers defined by the cylinder, the side blocks, the rotor, and the vanes, cylinder discharge holes for discharging refrigerant gas from the compression chambers, a discharge chamber for temporarily storing the refrigerant gas discharged from the cylinder discharge holes, a linear discharge gas passage for guiding the refrigerant gas from the discharge chamber to the downstream side of the discharge chamber, an oil separator arranged on the downstream side of the discharge gas passage and having an oil separation filter for separating the refrigerant gas and the oil from each other, and a discharge chamber for temporarily storing the refrigerant gas and the oil separated by the oil separation filter.

[0011] Then, according to the present invention, the discharge gas passage is made linear, whereby the oil containing high-pressure refrigerant gas flows smoothly through the discharge gas passage, thereby reducing the pressure loss of the oil containing high-pressure refrigerant gas.

[0012] Further, present inventionrelates to a gas compressor, wherein the height of an outlet opening on the oil separator side of the discharge gas passage is set to be the same as the height of an inlet opening of the discharge gas passage, whereby the discharge gas passage extends horizontally.

[0013] Then, according to the present invention, the oil separator side opening of the discharge gas passage communicating with the discharge chamber is set to be of the same height as the inlet opening thereof, whereby the discharge gas passage extends horizontally and is of the shortest length, whereby it is possible to further reduce the pressure loss of the oil containing high-pressure refrigerant gas.

[0014] Further, the present invention relates to a gas compressor, wherein the oil separation filter of the oil separator is positioned above the outlet opening of the discharge gas passage.

[0015] Then, according to the present invention, the oil separation filter of the oil separator is positioned above the outlet opening of the discharge gas passage, so that a large space can be secured for the oil sump below the oil separation filter.

[0016] Embodiments of the present invention will now be described by way of further example only and with reference to the accompanying drawings, in which:-

Fig. 1A, 1B, and 1C are an explanatory drawing showing a main portion of a gas compressor according to the present invention, Fig. 1A is a front view of a built-in oil separator in the gas compressor, Fig. 1B is a rear view thereof, and Fig. 1C is a sectional view taken along the line B-B of Fig. 1B.

Fig. 2A, 2B, and 2C are an explanatory drawing showing a main portion of a gas compressor in accordance with another embodiment of the present invention, Fig. 2A is a front view of a built-in oil separator in the gas compressor, Fig. 2B is a rear view thereof, and Fig. 2C is a sectional view taken along the line B-B of Fig. 2B.

Fig. 3 is a sectional view of a gas compressor according to the present invention.

Fig. 4 is a sectional view taken along the line A-A of Fig. 3.

Fig. 5A, Fig. 5B, and Fig. 5C are an explanatory drawing showing an oil separator mounted in the conventional gas compressor, Fig. 5A is a front view of the oil separator, Fig. 5B is a rear view thereof, and Fig. 5C is a sectional view taken along the line B-B of Fig. 5B.

[0017] A gas compressor in accordance with an embodiment of the present invention will now be described in detail with reference to the accompanying drawings.

[0018] The basic construction of the gas compressor of this embodiment is the same as that of the gas compressor shown in Figs. 3 and 4, in which the cylinder 1 is arranged between a pair of side blocks 2 and 3 and in which the rotor 4 is horizontally arranged inside the cylinder 1 so as to be rotatable, the vanes 9 being provided so as to be capable of jutting out toward the inner wall of the cylinder 1 from the outer peripheral surface of the rotor 4 and retracting therein. Inside the cylinder 1, the compression chambers 10 defined by the vanes 9, etc. are provided, and the volume of the compression chambers 10 repeatedly increases and decreases as the rotor 4 rotates, whereby the oil containing low-pressure refrigerant gas in the suction chamber is taken in and compressed. Further, the compressed oil containing high-pressure refrigerant gas is discharged through the cylinder discharge holes 14 as previously described. Thus, the component which are the same as those of the described gas compressor will be indicated by the same reference numerals, and a detailed description of such components will be omitted.

[0019] In the gas compressor of this embodiment also, the oil containing high-pressure refrigerant gas discharged through the cylinder discharge holes 14 as described above flows through the discharge chamber 16 and the discharge gas passages 24 and is led to the oil separation filters 18-1 attached to the oil separator 18. As shown in Fig. 1, in the gas compressor of this embodiment, such discharge gas passages 24 are formed into a linear shape so as to realize linearization thereof.

[0020] That is, one end 24a of each discharge gas passage 24 opens on the discharge chamber 16 side, and the other end 24b thereof opens on the oil separation filter 18-1 side of the oil separation filter 18. The section between one end (inlet opening) 24a of each discharge gas passage 24 and the other end (outlet opening) 24b thereof extends in a completely straight line, without being bent anywhere. Further particular explaining, the discharge gas passage 24 is formed linear whichever direction from seen, for example, front or rear view shown in Fig. 1B, plane view like shown in Fig. 1C, and side view like shown in Fig. 3.

[0021] Each discharge gas passage 24 is formed extending from the discharge chambers 16 to the oil separator 18 through the rear side block 3 in a punching manner. In this embodiment, the angle at which the discharge gas passage 24 reaches the oil separator 18 is not also changed.

[0022] That is, as shown in Fig. 5, each discharge gas passage 24 in the conventional gas compressor is bent substantially at right angles immediately after entering the oil separator 18 through the rear side block 3, whereas, as shown in Fig. 1, each discharge gas passage 24 of the gas compressor of this embodiment is not bent immediately after entering the oil separator 18 through the rear side block 3, and is formed linear.

[0023] Referring to Fig. 4, in the case of the gas compressor of this embodiment, two cylinder discharge holes 14, two discharge chambers 16, two discharge gas passages 24, and two oil separation filters 18-1 of the oil separator 18 are provided. This is due to the substantially elliptical inner peripheral configuration of the cylinder 1 and due to the structure in which five vanes 9 are provided. when the rotor 4 makes one rotation, intake operation and compressing operation are executed at two positions in the cylinder 1, and the portions of the oil containing high-pressure refrigerant gas respectively compressed at the two positions are separately guided to the oil separator 18.

[0024] As stated above, the two discharge gas passages 24 and 24 are both linear. However, they are not parallel to each other but are in a V-shaped arrangement in which they are directed toward the two oil separation filters 18-1 and 18-1 arranged side by side at the center of the oil separator 18.

[0025] In the gas compressor of this embodiment also, the oil containing high-pressure refrigerant gas discharged through the cylinder discharge holes 14 is led to the oil separation filters 18-1 of the oil separator 18 through the discharge chambers 16 and the discharge gas passages 24. When, as in this embodiment, the discharge gas passages 24 are attempted to be linear, the oil containing high-pressure refrigerant gas can be smoothly transferred from the cylinder discharge holes 14 to the oil separation filters 18-1, whereby the pressure loss of the oil containing high-pressure refrigerant gas is reduced, and the compressor performance is improved.

[0026] It is to be noted that the pressure loss of the oil containing high-pressure refrigerant gas also depends on the sectional area of the discharge gas passages 24; the larger the sectional area of the discharge gas passages 24, the less the pressure loss of the oil containing high-pressure refrigerant gas. Thus, it is desirable that the sectional area of the discharge gas passages 24 be set to be as large as possible.

[0027] Fig. 2 shows a configuration of a gas compressor in accordance with another embodiment of the present invention. Fig. 2A is a rear elevational view of an oil separator as seen from the rear side, Fig. 2B is an elevational view of the oil separator as seen from the side abutting the rear side block, and Fig. 2C is a sectional view taken along the line B-B of Fig. 2B.

[0028] In this embodiment, in order to further reduce the pressure loss of the oil containing high-pressure refrigerant gas, the height of one end 24a of each discharge gas passage 24, that is, the height of the discharge chamber 16 side inlet opening constituting the inlet of the discharge gas passage 24, is set to be the same as the height of the other end 24b of the discharge gas passage 24, that is, the height of the oil separator 18 side outlet opening, whereby each discharge gas passage 24 connecting the inlet and outlet openings 24a and 24b extends horizontally and is of the shortest length.

[0029] Thus, in this embodiment, in which the discharge gas passages 24 are of the shortest length, it is possible to restrain at a low level the pressure loss of the oil containing high-pressure refrigerant gas, which is discharged from the cylinder discharge holes 14 and led from the discharge chambers 16 to the oil separation filters 18-1 of the oil separator 18 through the discharge gas passages 24.

[0030] Further, since the discharge gas passages 24 extend horizontally, it is possible to minimize the resistance when passing the high-pressure refrigerant gas therethrough, which also leads to a reduction in pressure loss, thereby achieving a further improvement in compressor function.

[0031] As described above, in the gas compressor of the present invention, the discharge gas passages are linear, so that the oil containing high-pressure refrigerant gas flows smoothly from the cylinder discharge holes to the oil separation filters of the oil separator through the discharge gas passages, whereby the pressure loss of the oil containing high-pressure refrigerant gas of this type is reduced, thereby achieving an improvement in compressor performance.

[0032] Further, in the gas compressor of the present invention, the discharge gas passages are formed linearly, and the height of the inlet opening communicating with the discharge chamber is set to be the same as the height of the outlet opening on the oil separator side, whereby the discharge gas passages extend horizontally and are of the shortest length, thereby further reducing the pressure loss of the oil containing high-pressure refrigerant gas passing through the discharge gas passages to thereby achieve a further improvement in compressor performance.

Claims

1. A gas compressor comprising:

a cylinder arranged between a pair of side blocks;
a rotor horizontally arranged in the cylinder so as to be rotatable;
vanes provided so as to be capable of jutting out toward the inner wall of the cylinder from the outer peripheral surface of the rotor and retracting therein;
compression chambers defined by the cylinder, side blocks, rotor, and vanes;
cylinder discharge holes for discharging refrigerant gas from the compression chambers;
a discharge chamber for temporarily storing the refrigerant gas discharged from the cylinder discharge holes;
a linear discharge gas passage for guiding the

refrigerant gas from the discharge chamber to the downstream side of the discharge chamber; an oil separator arranged on the downstream side of the discharge gas passage and having an oil separation filter for separating the refrigerant gas and the oil from each other; and a discharge chamber for temporarily storing the refrigerant gas and the oil separated by the oil separation filter.

2. A gas compressor according to claim 1, wherein the height of an outlet opening on the oil separator side of the discharge gas passage is set to be the same as the height of an inlet opening of the discharge gas passage, whereby the discharge gas passage extends horizontally.

3. A gas compressor according to claim 2, wherein the oil separation filter of the oil separator is positioned above the outlet opening of the discharge gas passage.

FIG. 1A

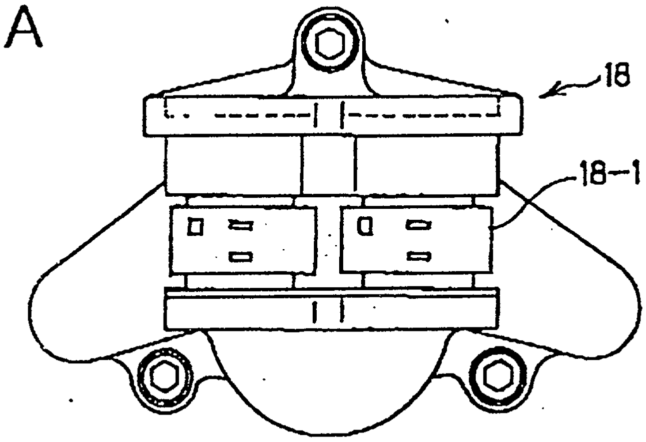


FIG. 1B

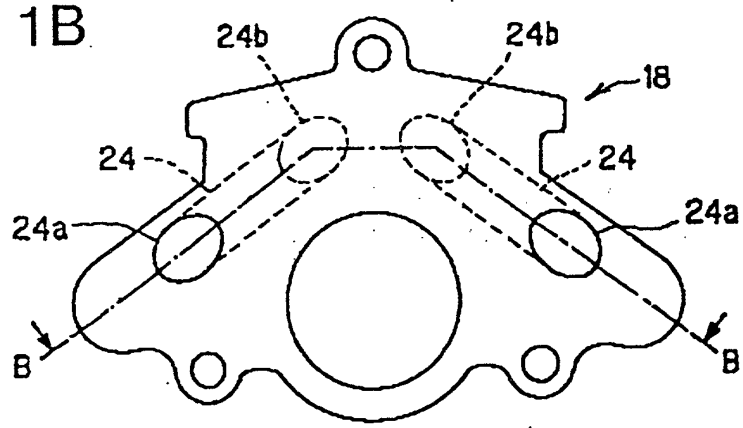


FIG. 1C

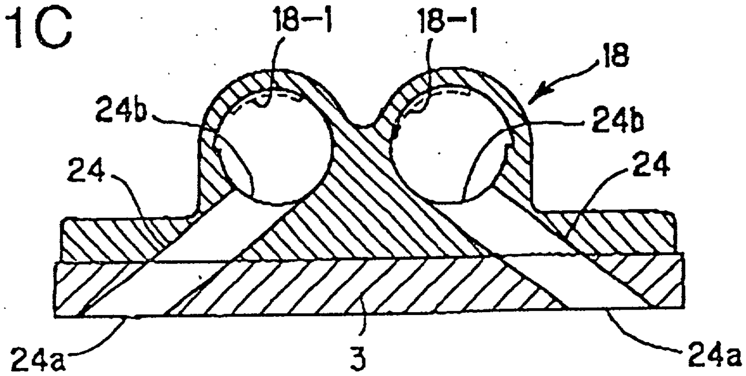


FIG. 2A

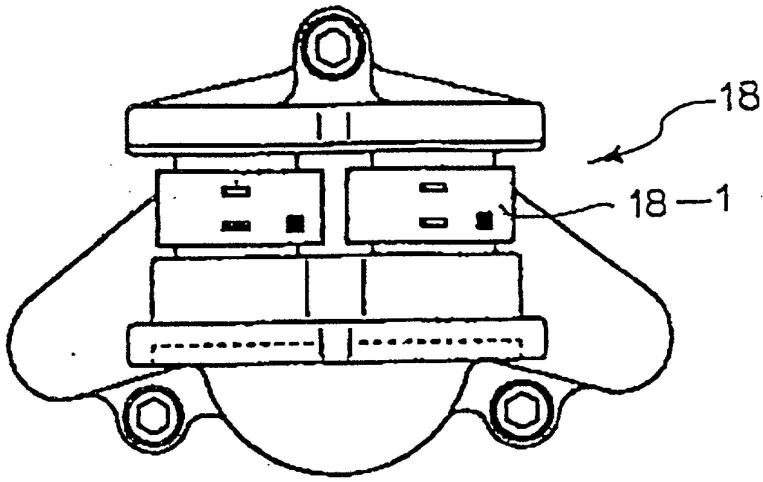


FIG. 2B

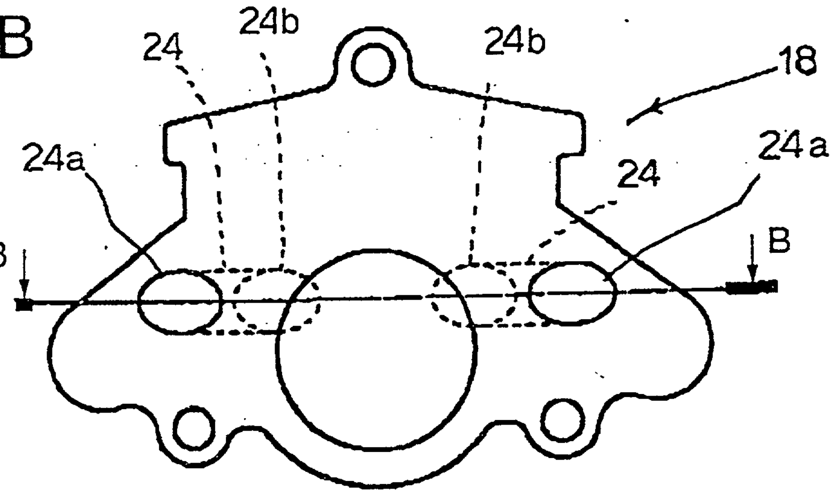


FIG. 2C

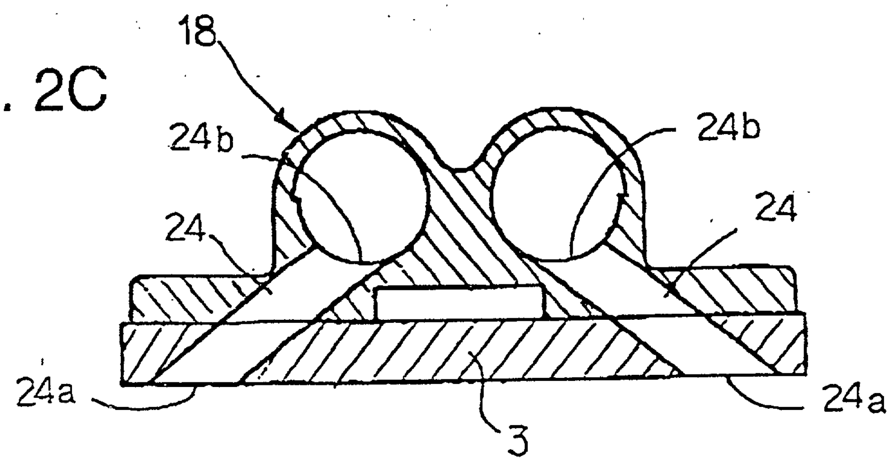
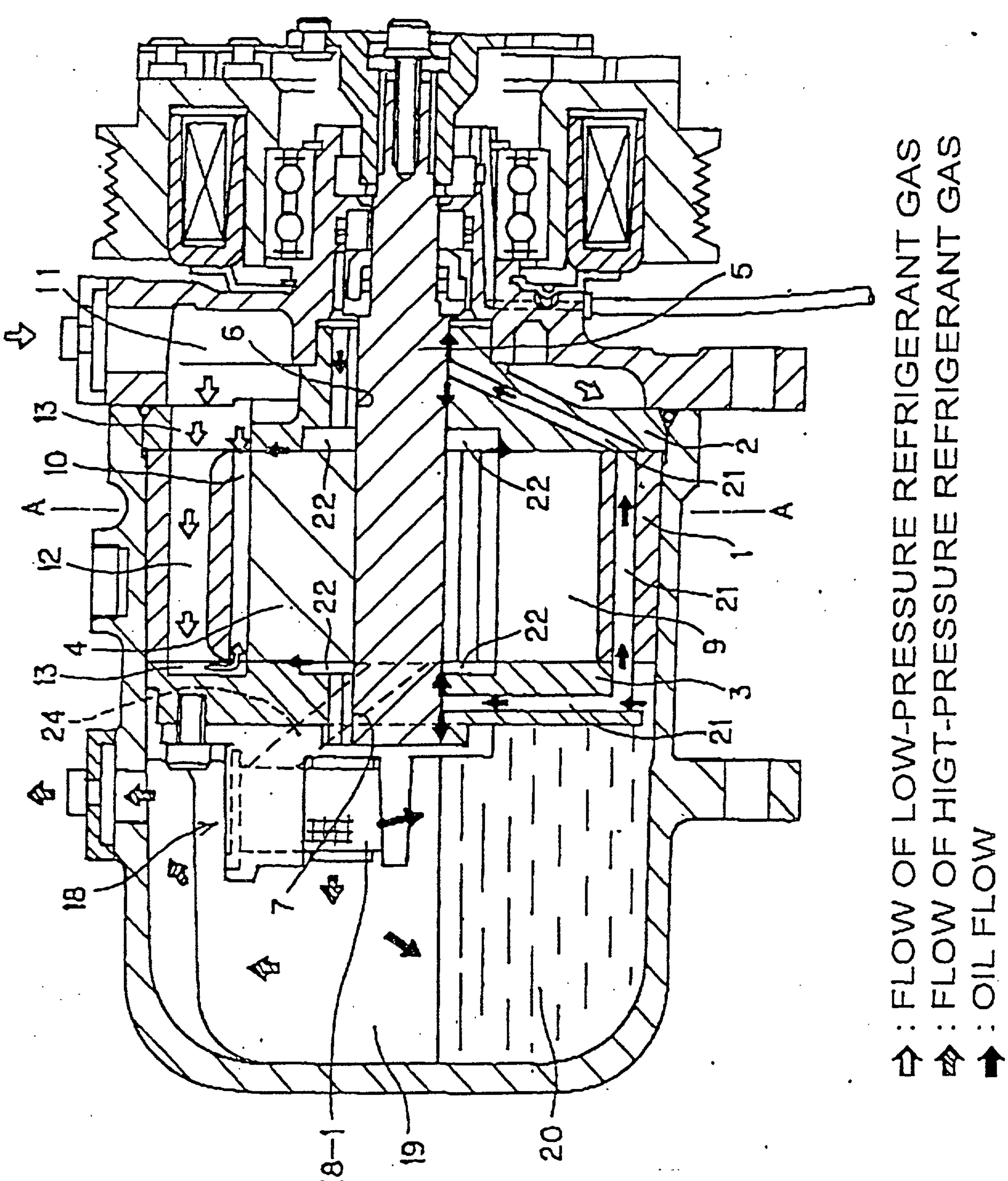


FIG. 3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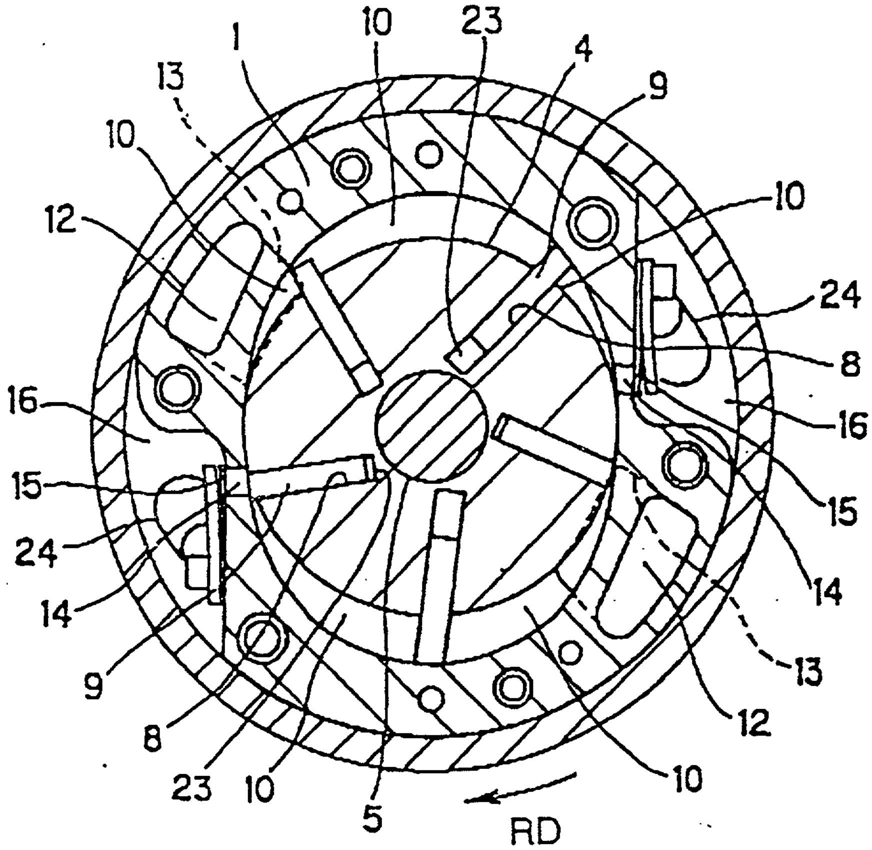
: FLOW OF LOW-PRESSURE REFRIGERANT GAS
: FLOW OF HIGT-PRESSURE REFRIGERANT GAS
: OIL FLOW

FIG. 4



PRIOR ART

FIG. 5A

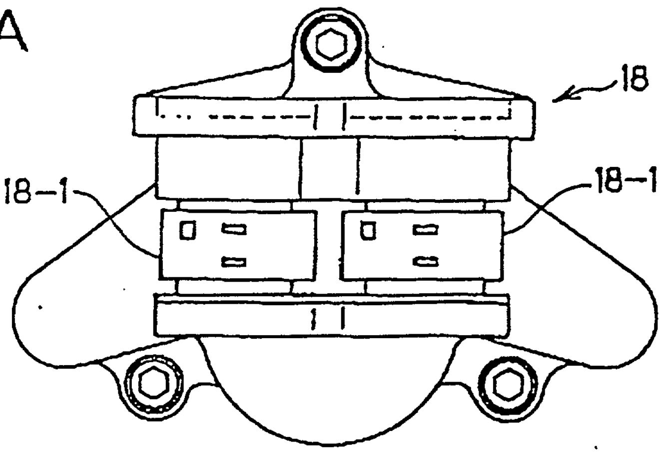


FIG. 5B

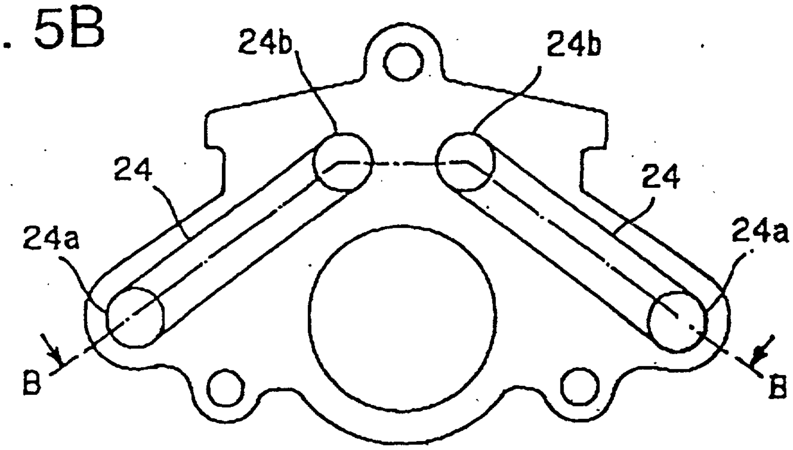


FIG. 5C